1 Pseudo Three-dimensional Surface Code

In this section, we describe the pseudo three-dimensional Surface Code on the looped pipeline architecture introduced in Section **??**. First, we describe how computation is performed on multiple 2D Surface Codes in a processor. Then, we extend this concept into a pseudo three-dimensional structure with a periodic cycle in the direction of the third dimension.

1.1 Quantum Processor

In fault-tolerant quantum computation, the Surface Code, introduced in Section **??**, is the most promising error correction code for calculations required in many quantum algorithms. On the other hand, quantum low-density parity-check codes (qLDPC) are often considered more suitable for quantum memory due to their high encoding rate. However, while a single Surface Code can encode only one logical qubit, it offers many advantages, such as a simple approach for universal logical operations using lattice surgery combined with magic state distillation.